A C T A P A R A S I T O L O G I C A P O L O N I C A
VOL. IX WARSZAWA, 31.VIII.1961 FASC. 18

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Orbopercularia raabei sp. n. from *Talitrus saltator* Mont. of the Baltic Sea

Orbopercularia raabei sp. n. z *Talitrus saltator* Mont. z Bałtyku

The present paper constitutes a part of studies on epizoic fauna on *Talitrus saltator* Montagu 1808 (*Amphipoda, Talitridae*). *Ciliata* from the *Peritricha* group were confirmed to occur regularly within the epizoa of *Talitrus saltator*. The present authoress classified this ciliate within the genus *Orbopercularia* Lust 1950 and has described it under the name of *Orbopercularia raabei* sp. n.

Besides the above ciliate, sporadic occurrence was observed of another *Peritricha* belonging to the genus *Opercularia* Stein 1854 or to *Pyxidium* Kent 1881. However, the present authoress failed in precise definition of the latter owing to its scarce occurrence. Still, its eventual identification with *Opercularia* sp. from *Orchestia gammarellus* (Matthes 1955) is not excluded. No data on *Peritricha* occurrence in *Talitrus saltator* were ever mentioned in the literature available to the present writer.

Neither Poisson 1923 nor Watson 1916 nor Kidder et Summers 1935 have confirmed *Peritricha* among *Talitridae*. Yet, Abonyi 1928 discovered *Lagenophrys orchestiae* on *Orchestia gammarellus* and *O. cavimana*, while Matthes 1955 noted the occurrence of an *Opercularia* species which he did not examine closely on a *Orchestia gammarellus* from the Yugoslavian coast. Thus our knowledge of the halopetrophilous *Amphipoda* seems to be very incomplete in contrast to the well known epizootic fauna of *Gammaridae*.

The *Peritricha*, provided with a discus and usually ranged within *Operculariiformes*, form a large group of animals, both epizootic and living free in fresh water. Matthes 1955 considers that *Operculariiformes* represent a fresh water group that has developed and differentiated on all kind of different hosts and in different conditions of the biotope. Yet, the author mentioned was searching for their genealogy among the primitive sea *Epistylidae*.

However, very few brackish or salt water epizootic species of *Opercullariiformes* have been known to science so far. These are: *Opercularia cupulata* Fauré-Fremiet 1948 from *Tymodoce truncata* (*Isopoda*), *Opercularia ligiae* Matthes 1955 described from a halopetrophilous brackish *Ligia italica* (*Isopoda*), *Epistylis balanorum* Mereschkowski 1877 from *Ba-*

lanus sp. sp. (*Cirripedia*), *Ballodora marceli* Remy 1928 from *Trichoniscus* (*Spiloniscus*) *provisorius* (*Isopoda*), and the already mentioned *Opercularia* sp. which was found by Matthes 1955 on *Orchestia gammarellus* (*Amphipoda*).

Both, the considerations of Matthes 1950, 1955 and the studies on the specificity degree of various *Opercullariiformes* (sensu Lust 1950) carried out by Nenninger 1948 and by Lust 1950 permit to regard them as possible indicators of the evolutions of their hosts. The phylogenetic parallellism between the parasites and the hosts sensu Dogiel will be returned to later on, in comparing the present studies to those of Matthes 1955, and to those of Lust 1950.

Many authors have carried out studies on *Peritricha* commensalia from the taxonomic point of view. Lust 1950 differentiated a new genus *Orbopercularia* out from the wide genus *Opercularia*; the present authoress has ranged the species here described within that genus.

Characteristics of the host biotope

The present study was carried out during the summer months (July, August) in 1959 and 1960 in the Hel Peninsula, a sandbank limiting the Bay of Puck in the southern coast of the Baltic Sea. The material consisted of common *Talitrus saltator* Montagu 1808 belonging to the halopetrofilous family of *Talitridae**.

Most of the *Talitrus* specimens examined in the present study originated from the sandy strand of the southern side of the Hel Peninsula in Kuźnica, i.e. from the Bay of Puck side; the Bay is very shallow here and an artificial channel, 3 to 5 m deep, runs as far as 100 to 150 m off shore. Although the inshore zone is relatively unvaried as regards the number of species, still it is very rich as the quantity of the flora and fauna representatives are concerned which results in numerous organic fragments cast ashore by the sea waves. The Kuźnica strand represents a narrow stripe of sand, 1 to 5 m in width. The strand is subject to the effect of considerable radiation of the sun; at the same time the commotion of the sea is very insignificant here due to the small area and to the protected shores of the Bay. The surf zone is only 30 to 80 cm wide on fine windless days, widening up to about 1 m during storms disregarding the general rise of the water level in the Bay caused by the sea water pouring into the brackish bay.

Talitrus occurred most frequently about 1 m from the water line. They used to leap over the strand surface on sunny days, while during bad weather they used to dig in into the sand some 15 cm deep. The holes of *Talitrus* were deeper with increasing distance off the water line reaching as much as 30 or 40 cm. The zone where they occurred regularly consisted of a medium grain sand soaked in brackish water from the Bay (3 to 4 ‰) but considerably aerated; this corresponded to the hygroarenal zone according to the classifi-

* *Amphipoda* were determined after E. Guryanova's "Bokoplavy morey SSSR. Opredeliteli po faune SSSR". 41 — Izd. Akad. Nauk SSSR, Moskva — Leningrad 1951, and after E. Chevreux et L. Fage: "Amphipodés. Faune de France" 9, 1925.

cation of the fresh water inshore surroundings as classified by Wiszniewski 1947. The salt level of these interstitial waters ought to be expected still higher owing to intense surface evaporation and to the instillation of more brackish water. Rains alone bring about a temporarily drop of the salt level; this phenomenon, however, is ineffective due to the considerable water perviousness of sand. The distance between the bank and the *Talitrus* specimens gathering together in water will adequately change with the daily and seasonal changes in the level of water, according to the ecological observations by Williamson 1954, as well as to those by Perdi et Papi 1953.

Talitrus saltator from the nortern strand (i.e. from the sea flank of the Peninsula) were examined too. Here, the strand occupies a stripe of land several meter or several dozens of meters wide. There is a typical inshore bank here, 6 to 8 m wide with a sharp slope. The commotion of the sea is much more heavy, and the surf zone is 2 to 4 m wide. The contents of salt is about 7 or 8 ‰ and seaweeds are very scanty because of the gravelly bottom. Under these conditions, *T. saltator* occurred also in the hygroarenal zone, i.e. some 1 to 3 m off the surf line; however, they were incomparably less in number; neither did they gather together. The above data are in perfect compliance with the observations of Palluault 1954.

Occurrence of *Orbopercularia raabei* sp. n.

Orbopercularia raabei sp. n. was confirmed as a regular epizoön of *Talitrus saltator*; it occurred on the pleopods of the curved abdomen where some amount of water (or, at least, a wet chamber) was present. Thus, the protozoan occurred in a characteristic liquid which Matthes has defined as "Atmungsflüssigkeit". According to the above author's description, this medium may be really regarded as a particular zoothelm in which a characteristic set of organisms occurs. In *Talitrus*, much as in amphibiotic *Isopoda*, this set is made up of *Peritricha* and of a representative of the *Chilodonella* genus, namely: *Chilodonella longipharynx* Kidder et Summers 1935. The resemblance to the set from the amphibiotic *Oniscoidae* is made more obvious also by the frequent occurrence of some of the nematode species (which bore a mass character in 1959), and by that of *Rotatoria* from the *Bdelloidea* group. However, the most important and dominating element of the set is represented by a species group belonging to the genus *Allosphaerium* which will be subject to special studies. Besides, there occurred in large numbers flagellates belonging to the genus *Bodo*, and bacteria.

Within this set, *Orbopercularia raabei* occurred as a subdominant, i.e. its occurrence was regular, yet it bore no mass character; it became dominant solely on those occasions when other protozoans were either absent or occurred less intensely. This used to happen on two occasions only:

1. In *Talitrus saltator* from the open sea strand. The species, the occurrence of which usually bears a mass character, occurred in very small numbers in these *Talitrus* specimens, while *Rotatoria* and *Nematoda* were completely absent. The level of *Orbopercularia raabei* sp. n. equalled then the normal intensity of this protozoan invasion in *Talitrus saltator* from the strand of the Bay.

To the present authoress' opinion, this phenomenon may be explained by the *Talitrus* population being very sparse on the sea strand which results in the hosts being less readily infested by contact; another reason to account for this is the trophically sterile character of the strand containing no such soil protozoans which could pentrate as facultative commensals.

2. In *Talitrus saltator* from the Bay of Puck strand, near Wielka Wieś. The strand has been devasted by the waste of the Fish Meal Factory and has been covered with silt. Here, *Talitrus* has occurred less frequently and has been almost not infected. *Orbopercularia raabei* sp. n. is the most resistant species here.

To the present writer's mind, the behaviour of *Orbopercularia raabei* in both of the above cases is indicative of the host's biotope influences telling less on them if compared with other ectocommensal protozoans. Lust 1950 confirmed that the sensibility to the external surroundings was the result of the loose relation between the protozoön biology and the physiology of the host, thus being related to the insignificant specificity degree, and the other way round. Consequently, *Orbopecularia raabei* sp. n. may be supposed — in accordance with the thesis of Lust — to be a very specific species, connected very closely with its own host.

Material and methods

The *Talitrus saltator* specimens were examined either directly after the material was collected or kept for a short period in the moist strand sand in a damp chamber. Sufficient humidity, temperature and aeration were necessary to ensure good conditions of *Talitrus* and insignificant changes in the ensemble of the ectocommensals. This is in accordance with Williamson's 1954 observations. The protozoans were rinsed in tap water, then examined and photographed in vivo with the utilization of the phase contrast; mitochondria were examined in vivo only, with Janusgrün B, while neutral red was utilized in examining the vacuoles. The Schaudinn fixed smears were stained with iron haematoxyline after Heidenhain. The dried smears were treated after Klein's silver method as simplified by Raabe. Besides, silver impregnation after Chatton (Corliss version) was utilized too.

Morphology of adult *Orbopercularia raabei* sp. n.

Orbopercularia raabei has all of the taxonomic characters of the genus as were communicated by Lust 1950.

1. Shape of the body. The body of the individual zooid of the colony represents an ellipsoid with flattened ends. The top flattening forms the edge of the peristome (or more precisely: "die Mundkloake" as termed by Gelei 1950), while the lower one forms the scopula. The height of the zooid varies within the range of 18 to 27 μ. Its maximum width, i.e. at the point slightly below the middle of the body height, is 14 to 25 μ. The diameter of the Mundkloake opening is about 7 μ at normal condition (i.e. its edge not contracted). Thus, the dimensions of *Orbopercularia raabei* are mar-

kedly smaller as compared with other species of this genus, and rather correspond to the size tolerances of other species belonging to the genus *Epistylis*.

2. Structure of the surface. The body is covered with pellicle, slightly folding at the widest part of the zooid (i.e. a little below the middle of its height) forming three or five ring-shaped bulges of ectoplasm. The depenings between the particular rings will absorb silver rather intensely forming circular stripes with apparent granulous bulges. This is the presumptive zone of formation of the telotroch ciliary girdle. Beside this, however, circular stripes with similar bulges run around the whole body. There is basically no difference between the stripes as cover the whole body and those of the presumptive ciliary girdle except — perhaps — for the latter absorbing silver more readily and the portion of cytoplasm between them becoming

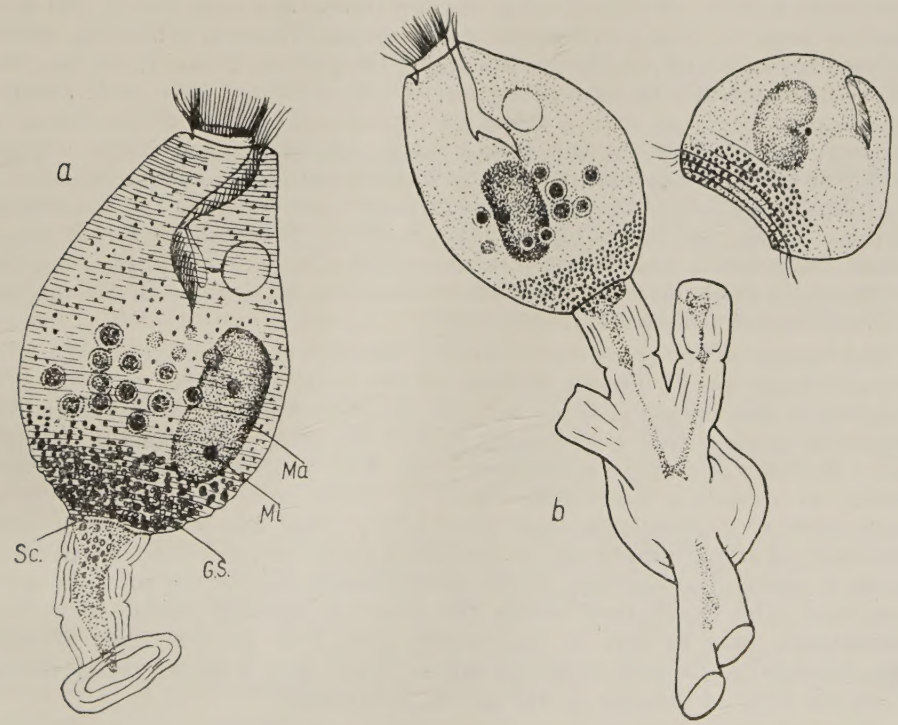

Fig. 1. a — Zooid, initial zooid of colony, phase contrast, imm. 90. Combined after photographs; b — A colony with forming telotrochs after I. H. preparation.

more intensely brown while absorbing silver. These phenomena may be observed in vivo in the phase contrast and particularly so in the silver impregnated preparations. The stripes total 70 or 90 in number including those as correspond to the ciliary girdle. The stripes form a circular system around the

main axis of the zooid (between the peristome and the scopula). These stripes are not perfectly parallel to each other: some of them merge into eachother. As a rule, however, they form a system of closed up rings. The character of these rings corresponds to the silver absorbing structure described by Raabe 1961 in *Scyphidia physarum* Clap. Lachm. 1856 and *Urceolaria patellae* Cuènot 1891. The present authoress failed to confirm any silver absorbing structure on the scopula in the material examined just the same as Raabe did in *Scyphidia physarum*.

3. Discus and vestibulum. The length of the peristome (according to the considerations of Geiei 1950, the term Mundkloake should rather be employed) is approximately one third of that of the body. The peristome cavity consists of three sections. The section A is formed by a common Mundkloake which then bifurcates to form two deepenings inside the body. One of them (section B) represents a long sack of the peristome cavity proper together with the cytostome; it disappears in the cytoplasm. The other branch (section C) is a shallow receptacle into which the C. V. contents enter; it thus corresponds to the cloaca. There is a marked isthmus between the section A on the one hand, and the sections B and C, on the other. The vault of the Mundkloake cavity (section A) is formed by a neck widening in the upper part and with a discus on top of it. The neck of the discus can contract and dilate. When the neck is being contracted, the discus is pulled inside the Mundkloake corking up the outside outlet of the Mundkloake. At this moment the border that marks the limit between the neck and the adjacent portions of the pellicle lining the margin of the peristome becomes deeper. The dilated neck is 8 μ in length, while it is 6 μ when contracted. As a rule, the neck is straight with an insignificant bending (as compared, for instance, to *Orbopercularia inclinata* Lust 1950).

The margin of the peristome is smooth which is characteristic of the whole *Orbopercularia* genus. During dilation of the neck, the discus is being lifted parallely to the margin of the peristome. The discus is flat, its diameter being nearly the same as that of the upper part of the neck, and is small, averaging 7 μ in diameter. This is in accordance with Fauré-Fremiet's 1905 observations on *Vorticella microstoma* Ehrbg. 1830, and with those of Matthes 1950 on *Opercularia reifi* Matthes 1950; the latter author considers that the small dimensions of the discus ought to be related to the rather excessive water insufficiency in the surroundings, i.e. in the semi-terrestrial conditions. The canal, over which the water is flowing outside out of the Mundkloake, may be seen in the dilated neck. Two parallel rows of adoral cilia, arranged spirally start on the discus. They form a spiral gutter through which the food is brought as far as the cytostome.

Those spirals run as follows: they encircle the discus and then go over onto the neck of the discus and on the wall of the Mundkloake border; they then run over it up to the opposite side of the section A. Next, the adoral rows form a spiral of almost 360° and reach the isthmus as severs the sections A and B. Finally, the last coil of the spiral enters the section B reaching as far as the cytostome. At that point the spirals disappear. The length of the cilia — about 8 μ — is rather considerable in both of the spirals and remains almost unchanged along their whole extent.

The filtered food is absorbed by the cytostome, while the excess of water is returned upwards by a backward movement propelling the water through the sections B and A, however, outside the channel formed by the two spirals. The water is unremittingly removed as far the discus is at the expan-

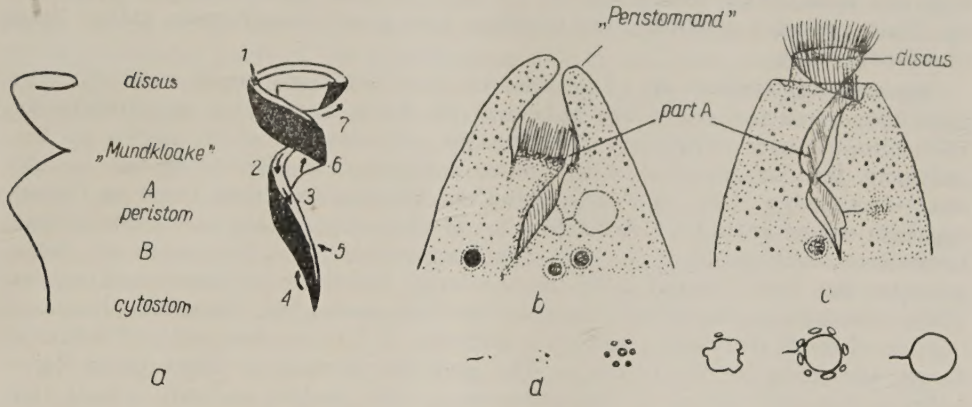

Fig. 2. a — An attempt at explaining the functioning of adoral spirals. Arrows 1, 2, 3 indicate movement of water together with food driven by the discus to cytostome over the groove between spirals. Arrow 4 indicates the backwards flow of water filtered in peristomal part B. Arrow 5 — endogenic water flow resulting from the C. V. secretion. Arrow 6 — backwards water flow in A section of Mundkloake. Arrow 7 — outwards flow of water; b — Moment of the C. V. contents pouring into the cloacal C section of Mundkloake; c — Moment of out pouring related to the discus ejection; d — Stages of vacuole formation in the area of cytoplasm

sion phase. A part of the contents of the section C — into which the C. V. excreta are poured — is periodically expelled together with that water. Expelling of water is occurring not merely passively; the movements of the discus and some waves surging down the spiral play their part in this respect too.

Consequently, the principal pattern of the functioning of the *Orbopercularia raabei* Mundkloake (according to the present authoress' mind) is rather similar to that presented by Lust 1950 in *Opercullariiformes*. The difference consists solely in the details of the track of the spiral in section A and in the system for water expelling from section C. The disposition of the deepenings B and C in respect to the neck and the discus seems to be slightly different.

Both of these sacks are situated laterally at the beginning of the neck and not in the same plane as it would result from the drawings published by Lust.

4. Cytoplasm. The cytoplasm is transparent and slightly yellowish. Several formations may be seen in it:

An insignificant thickening of the Mundkloake, forming a ring (myofibrillae?), may be seen near its margin (Peristomrand). The contraction of the Mundkloake may be watched particularly well when the discus is being drawn

into the body or the peristome is being closed at the period when a settled individual is transforming itself into a telotroch. Mitochondria are scattered over the whole cytoplasm in the peripheral portions; they are particularly dense near the scopula. These data are in perfect accordance with the observations by Fauré-Fremiet 1910 on the *Opercularia racemosa* mitochondria, and with the considerations of Gatenby 1941 concerning *Vorticella* sp. sp. Thus, properly speaking, the question here is of chondriomits rather than of mitochrondia.

Besides, agglomerations of specific opaque inclusions occur near the scopula too; these inclusions are spherical in shape, measuring approximately 1.5 μ in diameter. They are functionally related to the formation of the peduncle. Similar granules, with similar function and disposition has described Gatenby 1941 in *Vorticella* sp. sp. He has described them as "basal aggregations of granules". According to Gatenby, these are osmiophilous formations corresponding to the Golgi apparatus. The formation of these granules has been related with the secretory functions of the mitochondria. These observations have been born out in *Orb. raabei* too. However, the localization of these secretory granules is different in *Orb. raabei* and in *Vorticella* sp. sp. according to Gatenby. The granules mentioned above occur decidedly in the core portion of the peduncle in *Orb. raabei,* and not outside the core, in the hyaline zone.

Distinct spheres occur in the central part of the cytoplasm; they bear the character of nutrition vacuoles filled up with food varying in consistence, degree and colour. A definite cyclosis of vacuoles may be observed.

5. Contractile vacuole. The contractile vacuole is usually rather small, measuring 4 to 6 μ in diameter when most expanded. When the observations in tap water were carried out for a longer period, the fall in osmotic pressure resulted in considerable increase of the contractile vacuole size as well as in a more frequent expulsion. The expulsion occurs every 7 seconds, and even as often as every 5 sec. The expulsion took place as a result of the contraction of the whole body. At that moment, the contents of the contractile vacuole used to pour into the cloaca through the duct. According to the present authoress' own observations on the developmental stages of the vacuole, the latter has no walls of its own, yet it will steadily form in the same cytoplasmic area. Its increment results from the gradual fusion of water droplets filtered on the area of the cytoplasm. The occurrence of the duct connecting the C. V. with the cloaca is another constant feature. This duct does not seem to be a mere mechanical rupture of the cytoplasm. This question could not be settled due to the lack of osmium stained preparations. It results from the in vivo observations on the C. V. functioning and the structure of the latter that they would correspond to the most thorough examinations of *Paramecium* C. V. examined by Schneider 1960 by means of the electronic microscope. The droplets appearing on the cytoplasm area would correspond to the "Nefridialtubuli" after Schneider's terminology, while the cytoplasm thickening forming the ductus would correspond to the "Fibrillenbündel". The contents of the vacuole poured out into the section C could be further shifted into the section A and outside solely simultaneously with the expanding neck. Thus, the excretion of the C. V. contents will manifest itself by

the swelling of the cloacal part, and then by the expanding of the neck and pushing the contents into the section A. Next, the movement of the adjacent lot of the cilia of the adoral spiral (section A), and then only the contents will out through the isthmus between the discus neck and the edge of the peristome.

Consequently, the excretion seems to be related to the ejection of the discus acting as the sucking in motor piston. The many-stroke action principle of the particular parts of the Mundkloake during excretion makes this resemblance to a motor piston still more obvious. On the contrary, the present authoress failed at analyzing the wavy commotion of the spiral concomitant to the excretion. The difficulty consisted in the problem of the action of the cilia of the spiral being combined with the movements of the neck in such a way that the successive stages of the excretion water shifting are accompanied by the movements of the adjacent portions of the ciliature only. Neither any explanation could be found for the part the spiral plays at the excretion process nor found the answer to the question whether these movements disturb the normal functioning of the cilia of the spiral as are conveying the food to the cytostome.

6. Nuclear apparatus. The macronucleus is shield-like in shape and usually is situated across the body or obliquely. The Ma is often slightly bent. The dimension of Ma being 12 × 7 μ, *Orbopercularia raabei* sp. n. belongs — according to the Lust's 1950 diagram — to the small-nucleus group of *Orbopercularia*. The Ma exhibits a fine-grained structure.

The micronucleus usually occurs near the Ma and averages 3 μ in diameter. Specimens with two Mi adjoining each other may be often found. Various stages of the mitosis of the Mi were also frequently met with.

7. Peduncle. A distinct membrane connects the peduncle with the swallen scopula of the zooid. The part of the peduncle adjacent to the scopula is a little wider too. The structure of the part connecting the scopula with the peduncle corresponds to the description of *Opercularia notonectae* Fauré-Fremiet 1906 given by the latter author (1906). In the peduncle a core part, with a granular structure, may be distinctly seen, the grains exhibiting an obvious resemblance to the granular structure of the scopular part of the zooid. A thick hyaline envelope may be seen around the core layer; it is "the outer hyaline structure" in Gatenby's 1941 terminology; distinct longitudinal stripes are visible on that envelope (in accordance with the description of Fauré-Fremiet 1907 and with that of Rouiller et collab. 1956.

The peduncle of the initial specimen as founded the colony becomes wider to form a shield-like hyaline sole by which the zooid is attached to the substratum.

Originally, the specimens forming the colony are formed dichotomously and the entire colony has a common hyalinous shield. The peduncles of the individual specimens join together, and at the spot of their joining distinct thickenings of the core part may be seen. Most frequently a colony consists of 4, 6 and 8 specimens. Frequent occurrence of 6 specimens results from the irregular division of the zooids at the stage 4 and going over to the sympodial colony (in accordance with the consideration of Fauré-Fremiet 1922).

The present authoress happened to find a colony of 12 specimens; however, a part of the zooids was then already transformed into telotrochs. Thus, the number of 12 or 16 specimens in one colony should be regarded as the end of the colony development if the Fauré-Fremiet's 1922 theory on the endogenic necessity of telotrochs formation in *Peritricha* colonies might be accepted.

The peduncles at the stage of the 4, 6 and 8 specimens are approximately equal in thickness; however, a thickening may be seen in a peduncle, not yet divided dichotomously and widening to form a shield. The peduncles at the 4 and 2 specimens stage are very short, measuring as little as 6 μ in length. The distal portions of the peduncles of the colonies begin to elongate at the 6 and 8 specimens stages reaching as much as 15 or 20 μ in length. These observations corroborate once more the Fauré-Fremiet's 1922 considerations on the increment rate of the specimens in the colony.

In many *Opercullariiformes* species a small hyalinous plate frequently occurs at the end of the peduncle by which the colony is attached to the substratum; yet, in a few of them only, these plates reach considerable dimensions and form dishes of cups. Matthes 1955 showed that such formations occurred in many taxonomically distant protozoans [e.g. such as: *Opercularia cupulata* F.-Frem. 1948, *Orbopercularia scyphostyla* (Nenninger 1948), *Myoschiston sphaeromae* Precht 1935]; the aim of these formations is a mechanical protection of the colony and the increase of the adhesive surface. It also could be a convergent feature of adaptability to terrestrial conditions. In *Orbopercularia raabei* sp.n., the hyaline plate forms no dish nor cup at any developmental stage, and resembles the early developmental stages of the cup in the initial zooid of the colony. Such a shield, in the case of *Orbopercularia raabei*. serves the purpose of a still better attachment of the colony preventing its being mechanically torn off the moving host.

Telotroch formation

The present writer observed telotroch formation in vivo on several occasions. The telotrochs appeared either in colonies which have already reached their utmost degree of development or their formation was the reaction to the deteriorating conditions of the host's surroundings while cultivated in the damp chamber. Thus, after a few days of cultivation, most of the material examined contains already telotrochs, and a small number of the degenerating specimens, unable of any further transformation. In accordance with Lust's 1950 observations, it was observed that the telotrochs formation was brought about by gradual deterioration of the conditions, while the isolation of the ciliate or the killing the host caused death of the whole colony. The relatively delayed reaction of the host's environmental conditions (1 or 2 days) as compared to other commensals disappearing quickly, is another evidence of this protozoans being very specific. In accordance with the rule of Lust 1950, the telotrochs are formed the quicker in deteriorating environmental conditions of the host the less specific is the species of the commensal.

Telotroch formation is going on accordingly to the B type as described by Lust 1950. First, the peristome will shut, and swelling of the middle part of the zooid occur. Three rows, or perhaps even more, of basal corpuscles appear around it. The emerging of a girdle of cilia is associated with the zoöid tearing off its peduncle. The basal portion of the zoöid remaining beyond the aboral girdle, will be drawn in by the contracting and extending

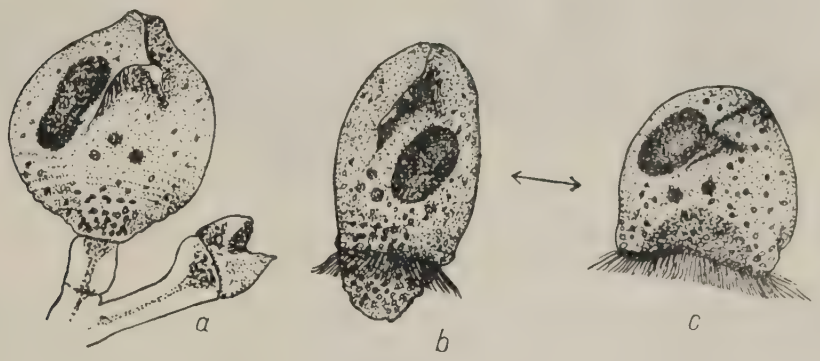

Fig. 3. a, b, c — Stages of telotroch formation. Infravital drawings

movements of the whole specimen, the same as observed by Raabe 1948 in *Ambiphrya miri* Raabe. The drawing in of the whole part of the cytoplasm adjacent to the scopula results in increase of the specimen's diameter, in the Ma shifting towards the peristomal part, and in a still more tight plugging of the peristome. The fully formed telotroch begins to move in the manner typical of *Peritricha-Mobilia* not sooner than after the drawing in process is completed. The entire process of drawing in lasts hardly a few minutes. Inspected in tap water, the contractile vacuole swells up; however, the present authoress had observed excretion on no occasion. The telotroch dimensions average 16 — 25 μ in diameter (at the aboral girdle), and 15 — 22 μ in height.

Transformation of the telotroch into a settled form

The initial stages of that process were observed in vivo. These stages were reverse to the process of the telotroch formation, and were also going on relatively quickly. A gradually increasing protrusion of the scopular part set in, the cytoplasm from the central parts of the body flowing into it. Granular structure could be seen within the protruding portion of cytoplasm; this could be functionally related to the process of the peduncle formation.

The whole protozoan became more lean, and the Ma returned back to its initial position thus unblocking the peristome. A renewed action of the Mund-

invaded the maritime ancestors of the terrestrial *Isopoda* or had mastered kloake, however, was observed on no occasion. The activity of the ciliary girdle died away approximately at the same time (at least the cilia of the

Fig. 4. a, b, c, d — Stages of telotroch transforming to become a settled form; after infravital photographs.

girdle had certainly disappeared). The stages of the formation of the initial individual's peduncle ("Initialindividuum" after Lust's 1950 terminology) were observed solely in I. H. preparations. The peduncle is short and widened to form a relatively large hyaline basal discus even at the earliest stages.

Diagnostic characters of *Orbopercularia raabei* sp. n.

Ciliate of the genus *Orbopercularia*. Dimensions of the zoöid 18 — 27 μ in height; 14 — 27 μ in width (as measured at the widest part); discus diameter — 7μ. The body of the zoöid pyriform in shape. The silver absorbing system consists of 70 — 90 circular striations. No silver absorbing system on the scopula. The presumptive sphere of the ciliary girdle is marked by transversal folds and by striations absorbing silver more readily. The discus supported by a neck is situated horizontally over the margin of the peristome. The length of the discus, together with neck, is approximately one third that of the body.

The zoöids are markedly separated from the peduncle; the peduncle is colourless. The specimens form small colonies with not more than 16, most frequently 6 or 8 specimens. The colony is formed dichotomously during the first two divisions, and later on — sympodially. The whole colony is attached to the substratum by means of a hyaline shield.

Development: formation of the telotroch — after the B type (Lust 1950). Telotroch dimensions: 16 — 25 μ in diameter, 15 — 22 μ in height. No division nor conjugation were observed.

Occurrence: on the pleopods and on the ventral part of body of *Talitrus saltator* Montagu 1808.

Area examined: the Polish coast of the Baltic Sea, the bay side of the Hel Peninsula.

Discussion

The question of the *Peritricha* epifauna is related to that of its immigration to the host. Matthes 1955 has pointed out to the two possible explanations of the origin of the commensals of the terrestrial *Isopoda*: they either had the latter already on land, i.e., the question was of the eurytope soil species

as a rule. In examining the epifauna of halopetrophilous *Isopoda* — *Ligia oceanica, L. italica* and *L. hypnorum*, Matthes considered both of these two possible explanations and arrived at the conclusion that the ancestors of

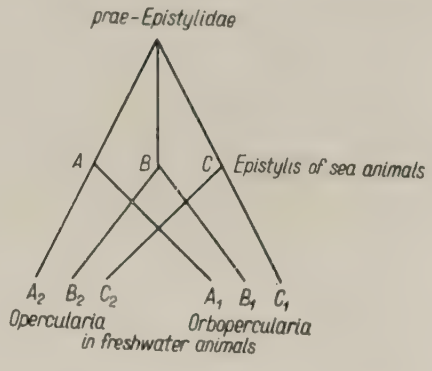

Fig. 5. Diagram of parallel evolution of species of the genera *Opercularia* and *Orbopercularia*.

Opercularііiformes might have invaded the hosts as early as the maritime period of life of the latter. He considers that the whole *Opercularііiformes* group originated from not specialized epizoic *Epistylidae* at the stage when the host gave up the sea to live in terrestrial conditions.

It is amazing to what an extent these considerations are true and may be applied in practice, and how closely they cover the whole set of the *Talitrus saltator* commensals. Thus, it would result from the above considerations that *Orbopercularia raabei* sp.n. is an old commensal bound with the host as early as at the *Epistylidae* stage. If, however, a phylogenetic parallelism between *Isopoda* and *Amphipoda* be admitted as well as that of their ecto-commensal *Peritricha*, then the non-monophyletic character of the genera *Opercularia* and *Orbopercularia* would be confirmed. The genera *Opercularia* and *Orbopercularia* would then form groups of species, evolution of which was most similar to that of maritime *Epistylidae*. The distinctive features of these two genera may converge.

Studies carried out by Matthes 1955 are a further evidence of this conclusion: the author mentioned confirmed convergent similarity in the peduncles in species of different genera (such as, for instance, *Orbopercularia lusti* Matthes 1955, *Orb. scyphostyla* Nenninger 1948, *Opercularia cupulata* Fauré-Fremiet 1948, or *Nidula multicapitata* Gaevskaya 1933) thus diminishing the significance of this taxonomic character.

The specificity of various primitive *Epistylidae* may be supposed to have had develop towards the formation of features characteristic of *Opercularia* on some occasions, while on other occasions it might develop towards the formation of these of *Orbopercularia*.

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STRESZCZENIE

Autorka podaje opis nowego gatunku orzęska z rodzaju *Orbopercularia* Lust 1950 (*Peritricha-Sessilia*) występującego powszechnie na pleopodach i w zagięciu odwłoka zmieraczka plażowego *Talitrus saltator* Montagu (*Amphipoda*), badanego na półwyspie Hel. *Orbopercularia raabei* sp.n. odznacza się dosyć znaczną specyficznością.

Autorka podaje dane, dotyczące biologii i cyklu życiowego tego pierwotniaka, tzn. tworzenie się telotrochów oraz przekształcanie się telotrochów w postać osiadłą. Natomiast brak jest danych o koniugacji i podziałach orzęsków. Autorka rozważa stanowisko systematyczne nowego gatunku oraz stosunki filogenetyczne w obrębie ektokomensalnych *Epistylidae*.

EXPLANATION OF PLATE I

Phot. 1. Cytoplasm inclusions of *Orbopercularia raabei* sp.n. Food vacuoles in the middle part, secretory granules at the basis, mitochondria in the oral part may be seen.

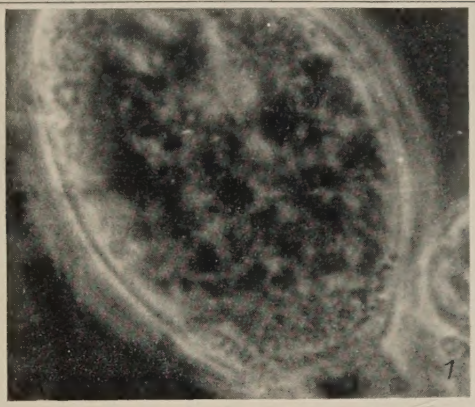
Phot. 2. Protozoan colony. In vivo.

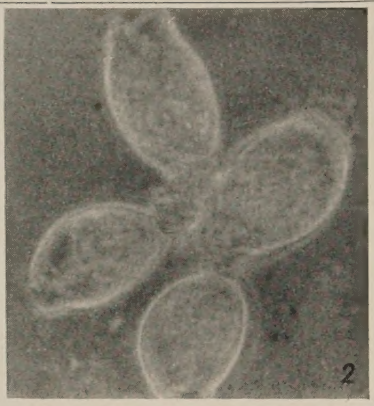
Phot. 3. Silver-absorbing system of the zooid. $AgNO_3$ impregnation.

Phot. 4. Moment of the discus drawing in into the Mundkloake. In vivo.

Phot. 5. Telotroch. In vivo.

Phot. 6. Transformation of a telotroch into a settled form. In vivo. In vivo photomicrographs have been executed by means of Exacta-Varex. Phase contrast. Imm. 90. Eyepiece 6.3.





J. Dobrzańska auctor phot.